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Red John Pumped Storage Hydro Scheme

Volume 5, Appendix 5.3: Outline Peat Management Plan

ILI (Highlands PSH) Ltd.

November 2018

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	November 2018	Submission	CA	Catherine Anderson	Associate Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

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Appendix 5.3 Outline Peat Management Plan

5.1 Introduction

5.1.1 As part of the assessment of effects on geology and ground conditions, an Outline Peat Management Plan (PMP) has been prepared to set out the principles to be adhered to during design, construction, operation and decommissioning in relation to peat management.

5.1.2 The Outline PMP seeks to avoid waste peat by applying the waste hierarchy of The Waste Management Licensing (Scotland) Amendment Regulations 2016, which is defined as follows:

1. Prevention;
2. Preparing for reuse;
3. Recycling;
4. Other recovery e.g. energy recovery; and
5. Disposal.

5.1.3 In accordance with the *Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste* (Ref 1), this Outline PMP will be updated post-consent and in advance of construction. The updated PMP will be informed by a detailed site investigation (SI) and detailed infrastructure design.

5.2 Sources of Information & References

5.2.1 This Outline PMP has been completed in accordance with the following guidance and sources of information.

- *Peatland Survey. Guidance on Developments on Peatland* (Ref 2);
- SEPA *Regulatory Position Statement – Developments on Peat* (Ref 3);
- Scottish Government *Peat Survey Guidance* (Ref 4);
- Scottish Natural Heritage (SNH) – *Good Practice during Wind Farm Construction.* Version 3 (Ref 5);
- SEPA *WST-G-052 - Developments on Peat and Off-Site Uses of Waste Peat* (Ref 6);
- *Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste* (Ref 1);
- British Geological Survey (BGS), GeoIndex (Onshore).
- Scottish Government, Scotland Soils, Online Soils map.
- Site Visits between May and July 2017 (Volume 2, Chapter 5: Geology and Ground Conditions, Section 5.3).
- Peat Survey – May 2018 (Volume 2, Chapter 5: Geology and Ground Conditions, Section 5.3).
- Preliminary SI Works – August 2018 (Appendix 5.1: SI Logs).

Peat Survey

5.2.2 As described in Chapter 5: Geology and Ground Conditions Phase 1 peat probing has been undertaken. Following completion of the Phase 1 peat probing, the requirement for a Phase 2 was scoped out.

5.2.3 Phase 1 peat probing was undertaken in May 2018, details of which can be found in Section 5.3 in Chapter 5 Geology and Ground Conditions and Appendix 5.2 Outline Peat Management Plan.

5.2.4 This PMP should be read in conjunction with Chapter 5 Geology and Ground Conditions and Figure 5.5: Site Visit Features and Peat Probes (Volume 3).

5.3 Peat within the Development Site

5.3.1 During the Phase 1 peat probing it was noted there was distinctly less peat recorded in the western and northern areas of the Development. This part of the site was found to be predominantly steeper, dryer, ground that is used for pastoral farming and is not a typical peat environment. Furthermore, the Scottish Government online soils map classes the soil in this area to predominately be 'Mineral soil - Peatland habitats are not typically found on such soils (Class 0)'.

5.3.2 Conversely, the eastern and southernly areas of the Development was characteristically peatier in nature and this is where the greatest depths of peat were recorded, as shown in Figure 5.3.1 (available at the end of this appendix). This aligns in with the BGS Geoindex Onshore which shows liner peat features across Ashie Moor and into Dirr Wood.

5.3.3 As such to improve the accuracy of the estimated volumes of peat proposed to be excavated during the construction of the Development, a boundary between the north-western and south-eastern has been created, as shown in Figure 5.3.1. This boundary delineates between areas of peaty soils and mineral soils.

5.3.4 However, despite being a peatier environment the eastern and southerly area predominantly had one long linear peat feature across Ashie Moor and Dirr Wood with smaller shallower pockets of peat located further east within the Development. Inbetween these peaty areas the soil depth was found to be shallow or none existent where bedrock was visible. These results correlate with the SI work that was carried out as described in Chapter 5: Geology and Ground Conditions.

5.3.5 The majority of the area where the headpond is proposed to be located, as shown in Figure 5.3.1 is, currently, covered with commercial foresty. In the forested areas between the pockets of peat, many uprooted windblown trees showed shallow deposits of mineral soil on top of a sandstone bedrock. This also aligns with the results of the trial pitting as part of the SI. The results of the SI show the areas between the pockets of peat had limited amounts of peaty soils that ranged between 250 mm and 500 mm and contained cobbles and boulders.

5.3.6 Furthermore, as shown in Figure 5.3.1, the majority of the probes within the Headpond footprint were between 0 and 0.49 m. As stated in (Ref 2) Section 3.3: "*Peat soil is an organic soil which contains more than 60 per cent of organic matter and exceeds 50 centimetres in thickness*".

5.3.7 Therefore peat probe results within the footprint of the Headpond with a total depth of less than 0.5 m have been classed as 'no peat' and not included in this assessment. The majority of the probes (96%) that were in the 0 to 0.49 m range are in fact between 0 and

0.15 m in depth which represents the shallow and stiff soil that was unable to be penetrated by the peat probes.

Acrotelmic and Catotelmic Layers

5.3.8 Peat is a body of sedimentary material, usually dark brown or black in colour, comprising the partially decomposed remains of plants and organic matter that is preserved in anaerobic conditions within an essentially waterlogged environment. There are two principal types of peat (Ref 6):

1. The upper (acrotelm) layer which is quite fibrous and contains plant roots etc. Acrotelmic peat is relatively dry and has some tensile strength.
2. The lower (catotelm) layers are highly amorphous, with very high water content and tend to have very low tensile strength. The structure of catotelmic peat tends to disrupt completely on excavation and handling.

5.3.9 Scottish Government Peat Survey guidance (Ref 4) states the acrotelm layer, the surface layer of a peatland within which all living vegetation exists, is usually less than 300mm thick but may be up to 500mm. Therefore, in the absence of detailed peat characteristics on site, it has been assumed the acrotelm layer is 450mm thick. It should be noted that this guidance was updated in 2017 (Ref 2). However, the definition of the depths of either acrotelmic and catotelmic was not stated.

5.3.10 For the purposes of this Outline PMP, the depth of the acrotelmic peat has been assumed at 0.45 m and any peat depth greater than 0.45 m is classed as catotelmic peat. It should be clarified that this statement is only relevant where probes show a depth of 0.5 m or greater.

5.3.11 Within the footprint of the Headpond, isolated pockets of peat were recorded as shown in Figure 5.3.1. It has been assumed that these pockets of peat will be excavated and the peat reused on site.

5.3.12 The total volume of peat anticipated to be excavated due to the Development has been based on the assumptions set out in this report. In practice, peat excavation is expected to be less due to micro-siting of components such the Landscape Embankment.

5.4 Measures to Minimise Peat Habitat Loss

5.4.1 The above ground infrastructure of the Development has been designed to minimise the impacts on peat and through an iterative design process has reduced, as far as reasonably practicable, the impact of the Development.

New Public Road (C1064) Realignment

5.4.2 The new public road that is proposed to be built around the headpond has been realigned to avoid areas of deep peat, as far as reasonably practicable. The start of the new public road is at approximately NH 60612 32690. This is between two areas of moderately deep peat between 2.0 and 2.99 m, on higher dryer ground.

5.4.3 The alignment then heads parallel to the existing public road along a ridge of higher ground between localised pockets of peat. In areas where pockets of peat need to be crossed floating tracks could be constructed in order to reduce even further the amount of excavated peat. As outlined in Chapter 4: Approach to EIA (Volume 2), this realignment can be located within a 100 m buffer and will be microsited to avoid deeper areas of peat and other environmental constraints.

Headpond

5.4.4 The peat probing identified that the Headpond is not located in an area with significant areas of peat. The majority of the peat recorded was between 0.0 and 0.49 m, with some unavoidable, localised pockets of peat being between 2.0 and 2.99 m deep.

Compound 4

5.4.5 The layout and location of Compound 4 has been designed to avoid deeper areas of peat.

Permanent Access Track Widening

5.4.6 The existing access track that is proposed to be permanently widened and is adjacent to small pockets of peat. The existing alignment will be followed as much as possible in order to reduce the impacts of any peat present. As outlined in Chapter 4: Approach to EIA, this 50 m Permanent Access Track can be located within a 100 m buffer and will be microsited to avoid deeper areas of peat and other environmental constraints.

5.5 Peat Excavation Volumes

5.5.1 Table 5.1 details the construction activities that will generate peat excavation and the approximate associated (maximum) volumes based on an assumed worst case scenario where areas of peat associated with the infrastructure listed in Table 5.1 are excavated to their full depth. These details are also presented in Figure 5.3.1.

Table 5.1: Excavated Peat Volumes

Infrastructure Type	Maximum Total Surface Area (m^2)	Total Peat Excavation Volume (m^3)	Estimated Acrotelm Excavation Volume (m^3)	Estimated Catotelm Excavation Volume (m^3)
Headpond	214,067	146,777	96,330	50,447
Access Tracks (widening)	5,646	1,081	1,081	-
New Public Road (C1064)	40,594	9,184	9,184	-
Compound 4	59,832	11,765	11,765	-
Total		**168,807**	**118,360**	**50,447**

5.5.2 It is estimated that approximately 168.807 m^3 of peat will be excavated, of which approximately 118,360 m^3 will be acrotelm and 50,447 m^3 will be catotelm.

5.6 Peat Reuse and Balance

5.6.1 This section sets out the measures to reuse peat and the expected peat reuse volumes. Measures to reuse peat have followed good practice guidance (Ref 3; Ref 6; Ref 5; and Ref 1).

Table 5.2 shows the breakdown of how the excavated peat will be re-used across the Development.

Landscape Embankment Hollow

5.6.2 The Development has a Landscape Embankment, as shown in Figure 2.3 and 2.10 (Volume 3). The majority of the Landscape Embankment is a shallow sloped embankment that extends the northern side of the Headpond Embankment. In addition to this, there is a liner bund that runs south to north on the western side of the Headpond.

5.6.3 This bund is offset from the Headpond Embankment which has created a hollow between the Landscape Embankment bund and the Headpond Embankment. This hollow is located roughly where an existing peaty hollow is located and would be a suitable location to reuse peat on-site, reinstating the existing hollow as much as possible. The hollow will replicate the current peaty environment and surrounding area as far as reasonably practicable.

5.6.4 It is anticipated that the exact size and design of the landform will depend on how the design evolves through the detailed design stage and the construction phase. However, it is envisaged that the recreated peaty hollow would likely be a blanket bog within a basin.

5.6.5 It is anticipated that the unconsolidated catotelmic peat will be able to be stored at a depth of around 2.55 m and this will be topped with the acrotelmic peat that will be around 0.45 m deep. By retaining and reinstating the acrotemlic turves an appopriate species mix and seed bank will be available for the restroration of this area. It is recommended that the following principles are adopted in the final method statements for embankment hollow creation.

- All peat and soil sourced from the existing peaty hollow is placed within the new embankment hollow, where possible.
- Peat handling activities should be overseen by an Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to.
- Additional unconsolidated uncontaminated peat, if suitable, will also be placed within the embankment hollow.
- The peat will be reinstated in the embankment hollow to a similar depth to the existing peaty hollow in order to recreate, as far as reasonably practicable, a similar environment.
- Engineered peat dams will be required to be created at either end of the hollow in order to hold back the peat and to ensure that the peat remains saturated and does not dry out over time.
- The hollow may need to be engineered to replicate the hydrological condition of the hollows the peat has been excavated from. This could be through the use of liners which would maintain the water content of the peat by preventing any seepage into the either the Landscape Embankment or Headpond Embankment.
- The reinstated hollow will be subject to detailed design to ensure there are no stability issues.

5.6.6 The dimensions of the final reinstated hollow will be dependent on the shape and design of the Headpond Embankment, as well the bund associated with the Landscape Embankment. Therefore, the dimensions detailed in Table 5.2, are likely dimensions of the hollow, ensure a maximum reinstatement depth of 3 m is maintained.

5.6.7 Other areas of the Landscape Embankment, other than the hollow, have been identified that could be a location to store acrotelmic peat on the surface of the Embankment these are shown in Table 5.2.

Permanent Access Track – Headpond to Compound 1

5.6.8 Acrotelmic peat placed on verges will not exceed 20 m on the western side and 10 m wide on the eastern side along tracks and passing places.

New Public Road Realignment

5.6.9 Acrotelmic peat placed on verges either side of the road will not exceed 5.5 m wide and 0.45 m deep along either side of the new public road. It is anticipated that the verges, either side

of the public road, will be used for temporary storage of material and hence will be area of already disturbed ground.

Compounds

5.6.10 As the end of construction Compound 4 will be reduced in size, an area of approximately 35,335 m² will be reinstated using excavated peat. Acrotelmic peat placed at a depth of 0.45 m will be placed over this area.

Table 5.2: Peat Re-use Volumes

Location	Length (m)	Width (m)	Width of Peat at bottom of hollow (m)	Depth (m)	Cross-sectional Area (m^2)	Plan Area of (m^2)	Quantity (m^3)	Volume of Acrotelmic peat re-used (m^3)	Volume of Catotelm peat re-used (m^3)
Landscape Embankment Hollow	900	50	2.50	3.00	78.8	45,000	70,875	20,250	50,625
Landscape Embankment Berm	n/a	n/a	n/a	0.45	n/a	27,249	12,262	12,262	n/a
Landscape Embankment North	n/a	n/a	n/a	0.45	n/a	113,903	51,256	51,256	n/a
Access Tracks - West 20 m	945	10.0	n/a	0.45	n/a	18,900	4,253	4,253	n/a
Access Tracks - East 10 m	945	5.0	n/a	0.45	n/a	9,450	2,126	2,126	n/a
New Public Road - West 8 m	2,450	5.5	n/a	0.45	n/a	19,600	6,064	6,064	n/a
New Public Road - East 8 m	2,450	5.5	n/a	0.45	n/a	19,600	6,964	6,064	n/a
Compound 4	n/a	n/a	n/a	0.45	n/a	35,335	15,901	15,901	n/a

Monitoring

5.6.11 To ensure that that the peat habitat is recreated and maintained as far as reasonably practical monitoring of the reused peat will be carried out. The first phase of the monitoring would be done at the pre-construction stage so that a baseline is produced to compare against. Once construction is complete monitoring could be carried out on annual basis for the first five years. Monitoring measure could include:

- Fixed point photography of the area pre and post-construction to maintain a record of habitat and vegetation community.
- NVC survey pre and post-construction, including quadrats at fixed locations which will be used to determine re-establishment of bog community following restoration.
- An assessment post-restoration of vegetation cover.
- Hydrological monitoring per and post-construction which could include dipwells to monitor water table depth.

Peat Balance

5.6.12 Table 5.3 shows the peat balance for the Development. It is anticipated that almost all of the 168,807 m³ of excavated peat can be reused within the Development. A total of 7 m³ of peat may not be capable of being used and would thus be treated as waste. Overall, this should be considered not significant and that the peat excavation and reused is balanced. Measures for the recycling, other recovery and disposal of waste peat are therefore not required.

Table 5.3: Peat Balance

	Volume of Acrotelmic peat (m³)	Volume of Catotelmic peat (m³)	Total (m³)
Excavated	118,360	50,447	168,807
Reused	118,175	50,625	168,800
Waste	185	-178	7

5.7 Peat Handling Method Statement

5.7.1 It will be necessary for the final PMP to detail precise methods and timing involved in handling, storing and reusing excavated peat materials. The final method statement should follow the principles detailed below, in accordance with the good practice guidance ((Ref 3; Ref 6; Ref 5; and Ref 1).

- The surface layer of peat and vegetation (acrotelm) will be stripped separately from the catotelmic peat.
- Acrotelmic material will be stored separately from the catotelmic material.
- Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be reused.
- Less humified catotelmic peat (consolidated peat), which maintains its structure upon excavation, should be kept separate from highly humified amorphous peat.
- Acrotelmic material will be replaced as intact as possible once construction is complete.
- To minimise handling and transportation of peat, acrotelmic and catotelmic peat will be replaced, as far as is reasonably practicable, in the location from which it was removed. Acrotelmic material must always be placed on the surface.

5.8 Temporary Peat Storage

5.8.1 It will be necessary for the final PMP to detail precise methods and timing involved in temporary storage, should this be required, the preference being that peat is placed at its end use location directly from it being excavated. The final method statement should follow the principles detailed below, in accordance with the good practice guidance (Ref 3; Ref 6; Ref 5; and Ref 1).

- Temporary storage of peat should be minimised.
- Suitable storage areas should be sited in areas avoiding watercourses, stability risk, Groundwater Dependent Terrestrial Ecosystems (GWDTE's) or other sensitive areas.
- Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials.
- Timing the construction work, as much as possible, to avoid periods when peat materials are likely to be wetter.
- Transport of peat on site from excavation to temporary storage and restoration site should be minimised.
- Excavated peat will be prevented from drying out or desiccating as far as possible. This can be achieved by minimising disturbance or movement of the spoil peat once excavated.
- Consideration will also be given to spraying the peat to keep it moist in periods of prolonged dry spells, should the ECoW require it.
- Designated areas for stockpiling / side casting will be generally flat and stable. Where required peat will be stockpiled taking due regard to potential loading effects for peat slide risk.
- Where surface run-off may be encountered, stockpiles will be bunded, whereby bunds will extend above the toe level of the stockpile and water quality monitored before discharge.

5.8.2 Based on the guidance outlined above, temporary storage areas will be set up on site, mainly around the headpond, in order to safely store the peat that is anticipated to be encountered. On the basis that the total volume of peat anticipated to be excavated is 168,807 m³, it is anticipated that there is sufficient space within the 930,000 m² headpond and Landscape Embankment footprint to temporarily store the entire excavated peat volume of the worst case scenario.

5.8.3 The Landscape Embankment makes up around 250,000 m² of the headpond footprint and will be an area of the development where significant excavation activities will not be carried out and as such would be a suitable location for temporarily storing peat, in particular catotelmic. It is anticipated that the catotelmic peat would be stored for a longer period of time compared to that of the acrotelm, which will be able to be used for the reinstatement of the access tracks and compounds earlier in the construction of the development.

5.8.4 Reducing the double handling of peat across the site is important and having a more permanent area to temporary storage peat will allow this to happen. The Landscape Embankment is also away from the main excavation and material processing areas so should not restrict the construction works of the Headpond.

5.8.5 There are areas within the headpond and Landscape Embankment footprint to temporary store peat to satisfy the following criteria.

- Located out with the 50 m watercourse buffers.
- Located out with the GWDTE buffer zones.
- Located on peat of < 3 m depth (with a majority of storage areas located on peat < 2 m depth).

- Located on slopes of < 5°.

5.9 Conclusion

5.9.1 Across the Development there area of peaty soils and mineral soils. Within the areas of peaty soils, pockets of peat have been reordered and it is anticipated that the total volume peat required to be excavated during construction is 168,807 m³.

5.9.2 Based on the information currently available it is considered there are sufficient reuse options for peat within the Development Site, which would mitigate the need for any substantial wastage and subsequent removal of peat from the Development Site.

5.9.3 Proportionally compared to the anticipated earthworks that are required to be undertaken within the Development the anticipated volumes of peat is only 2.5% of the total excavation works.

5.9.4 The exact method and locations that could be used for temporarily storing the peat will be developed in the final PMP and submission of the finalised Contractor Construction Environmental Management Plan.

5.9.5 This Outline PMP will be developed into a final PMP following further ground investigation, as well as the detailed design of the Development, post-consent.

5.10 References

Ref 1. Scottish Renewables & SEPA. (2012). Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

Ref 2. Scottish Government, Scottish Natural Heritage, SEPA. (2017). Peatland Survey. Guidance on Developments on Peatland.

Ref 3. SEPA. (2010). SEPA Regulatory Position Statement – Developments on Peat.

Ref 4. Scottish Government. (2014). Peat Survey Guidance.

Ref 5. SNH. (2015). Good Practice during Wind Farm Construction Version 3.

Ref 6. SEPA (2017). SEPA WST-G-052 - Developments on Peat and Off-Site Uses of Waste Peat.

Ref 7. SEPA WST-G-052 - Developments on Peat and Off-Site Uses of Waste Peat

Ref 8. BGS, GeoIndex (Onshore).

Ref 9. Scottish Government, Scotland Soils, Online Soils map. Available: http://map.environment.gov.scot/Soil_maps/?layer=10# [Accessed 12/10/18].

Project Management Initials: CA Designer: LC Checked: SY Approved: CA

Infastructure Type	Total Area (m2)	Total Peat Volume (m3)
Headpond	214,607	146,777
Access Tracks (widening)	5,646	1,081
New Public Road (C1064)	40,594	9,184
Compound 4	59,832	11,765
Total peat to be excavated (m3)		168,807

Scale @ A3 1:12,500

0 0.5 1 km

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PROJECT
RED JOHN PUMPED STORAGE HYDRO

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KEY

- Development Site boundary
- Excluded from Development Site boundary
- Peaty environment
- Not a peaty environment

Infrastructure component

- Headpond footprint
- Compound
- New Public Road 15m excavated width
- Access Road - Permanent 20m excavated width;
- Access Roads - Temporary 20m excavated width
- Pocket of peat

Peat Depth Interpolation (m)

- 0.00 - 0.50
- 0.51 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 5.00

NOTE:
The peat depths are based on an interpolated peat surface, based on individual peat probes taken across the site (See ES Figure 5.#).
The results are indicative only and should not be relied upon for detailed design or construction.

Peat Interpolation method used:
Inverse Distance Weighting

Peat excavation calculations undertaken within surveyed areas only and on specified infrastructure elements within the peaty environment.

TITLE
FIGURE 15.3.1
PEAT EXCAVATION

REFERENCE
RJ_181031_EIA_A5.3.1_v1

SHEET NUMBER
1 of 1

DATE
31/10/18

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